LIFE HISTORY AND HABITS OF THE WOOD MOTH *XYLEUTES LITURATA* DON. (LEPIDOPTERA: COSSIDAE) IN TASMANIA

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Abstract

The life history of *X. liturata* is discussed. Food plants are listed and factors which make individual trees more prone to damage than others are described. The egg laying process of the adult female is described as well as larval development and duration of larval cycle. Particular attention is given to the construction and form of the pupal gallery.

Introduction

Xyleutes liturata Donovan is a large, greyish, *Acacia*-feeding cossid, common and widespread in Tasmania where it lives in a variety of habitats from coastal sand dunes and heathland to wet sclerophyll forest.

Dodd (1916) and Littler (1904) write of great damage caused by *X. eucalypti* Herrich-Shaeffer (a misidentification as *X. eucalypti* does not occur in Tasmania) to wattles in Tasmania. Dodd (1916) stated "I understand that *Xyleutes eucalypti*, or a closely related species, has become so plentiful in Tasmania that large numbers of wattle trees are killed by the caterpillars". This is somewhat of an exaggeration as I have never seen a tree killed by the activities of *X. liturata* alone, and healthy trees suffer no serious effects, and the sap wood grows over old emergence holes.

Littler (1904) writing from Launceston states "It is hardly possible to find a tree that has outgrown the sapling stage without one or more–most frequently more–tunnels formed by the larvae of this moth". This is certainly the case today in some areas of wattle-dominated country which are infested with larvae of *X. liturata,* many trees having two, three or more larvae boring in them, often of the same age.

Food plants

In my experience *X. liturata* will oviposit on any suitably sized tree in the *Acacia* genus. The usual food plants in Tasmania are the common and widely distributed black wattle *Acacia mearnsii* De wild, silver wattle *Acacia dealbata* Link, blackwood *Acacia melanoxylon* R. Br. and the narrow-leaved wattle *Acacia mucronata* Willd. ex H. Wendl. *X. liturata* also infests a species of small shrub-like *Acacia* that grows behind sand dunes in coastal regions.

A variety of introduced acacias are also food plants for this species, the most commonly grown and thus the most commonly infested are the cootamundra wattle *Acacia baileyana*, F. Muell, and the Sydney golden wattle *Acacia longifolia* (Andr.) Willd.

Sickly and damaged trees are more prone to attack than healthy ones and are usually covered in suitable sites for egg laying through the activities

of other insects such as beetles which leave emergence holes and cause bark to crack and peel. Old, badly damaged wattles often have several dozen larvae of *X. liturata* of various ages boring in them.

Oviposition and egg

The eggs are pale yellow, oviod in shape and approximately 1 mm long and are accompanied by a glutinous secretion which hardens. Common (1970) states that *Xyleutes* larvae live beneath this hardened secretion for some days before dispersing.

Female moths lay their eggs in cracks and depressions in the bark of the food plant. Another common site for oviposition is the depression formed where a small branch leaves the trunk.

The female moth generally alights on the lower trunk and commences to probe the bark with its long brown ovipositor, (some 20-25 mm long) seeking out suitable cracks in which to deposit the eggs. The moth makes its way up the trunk of the tree in this manner. When a suitable crack or hole is located the ovipositor is pushed inside and the eggs pumped into the depression until it is full.

Eggs are laid in this fashion all over the tree as high as the trunk is at least 12 cm thick. *X. liturata* larvae bore in the heartwood of trees and so in climax wattle scrub where trees often have trunks 92 cm thick the moths oviposit on branches that are between 8 and 30 cm thick. In northern Tasmania large silver wattles *Acacia dealbata* grow in rainforest gulleys. These trees are very large and in this habitat *X. liturata* larvae live high up in the canopy among the thinner branches. Their presence was only discovered when branches blown down in storms were examined and found to contain larvae.

Larva

The habits of the newly emerged larvae were described by Littler (1904) who thought he had discovered a spiders web in his study but on closer examination proved to be "a vast number of minute larvae of this moth suspended by threads, which from their intermingling had formed a web". I have never seen this behaviour in the wild and no doubt it can be attributed somewhat to the alien environment of a setting board on which the larvae Littler described emerged. My own observations have led me to believe that the larvae disperse over the trunk of the tree and crawl into minute cracks and then start their wood boring existence.

The small larva was further described by Littler (1904) who gave the colour as being "dark fawn, head black, with a few hairs projecting along the sides and a greater number on the anal segment". The larva at this stage is approximately 2 mm long.

In the same article Littler goes on to describe the habits of the tiny larvae, stating that they were "extremely active, both when making progress on a level surface, and when suspended over the edge of the table and letting themselves down by threads".

The first few instars are generally spent in the sap wood near the bark. When the larva has reached about 30 mm in length it begins to bore inwards towards the heartwood. Once the heartwood is reached the bore is then continued vertically up the tree. Littler (1904) states "Their tunnels commence some distance up the trunk of a tree and are pushed down towards the roots". However, I have examined hundreds of bores and not one has ever bored down in the direction of the roots.

From its earliest stages until it is 50-60 mm long the larva is often colourful, it can be any of several shades of reddish pink or yellowish brown with dark brown spots and speckles. When the larva is approximately 60 mm it will generally begin to lose its colouring until it is a creamy white. Some adult larvae however retain a pinkish flush or small brown speckles.

Once inside the heartwood the larva lengthens and widens its bore to accommodate its increasing bulk, the frass ejection hole is likewise enlarged, but rarely does it get much larger than 4 mm in diameter. Much frass is ejected which piles up sometimes several centimetres deep at the base of some trees during the several years of the larva's life. As the larva grows it begins to bore out horizontally away from the heartwood. Here it obtains much of its nutriment from the sap flow of the tree by feeding at the top and bottom ends of its bore on the constantly forming young wood and sappy matter. With eighteen months or so to go before the emergence of the adult the larva bores all the way out to the bark and then begins to widen the centre of its tunnel in order to accommodate the cocoon. The wood chewed out in this widening process, as well as all excreta, is used to seal off the frass ejection hole and the bottom half of the tunnel, thus no frass is ejected for a considerable period before the emergence of the moth. Frass and wood scrapings pushed into the lower bore are very densely packed, effectively sealing it off from any predators. The bore at this stage is usually about 300 mm long and some 25 mm wide in the centre of the tunnel. The longest bore I have encountered was 400 mm long and the widest bore was some 30 mm across in its middle.

In its last year the larva begins to construct the coccoon in August or September, as soon as the weather starts to warm up after winter. The cocoon is constructed with a tough outer layer of silk and flakes of wood. Inside it is padded with soft, but strong, yellowish brown silk, its opening as Dodd (1916) states "is a broad felt like ring meeting but only slightly closed in the centre".

When the cocoon is almost completed the larva chews the bark over the emergence hole almost through, leaving a circular piece of bark about cardpaper thickness, this dried and cracks in the sun and so the larva usually strengthens the perimeter with strands of silk so it does not blow off or dislodge before emergence; some however do fall.

At this stage a female larva may be 125 mm long and just over 20 mm in diameter. I have never seen a larger one than this but I have heard unconfirmed reports of larvae exceeding 150 mm in Tasmania. Froggatt (1864) reported larvae of *X. liturata* reaching 200 mm but this would appear to be an exaggeration. A male larva is considerably smaller with some being only 40 mm long immediately prior to pupation.

After chewing the bark over the emergence hole cardpaper thin the larva retreats to the cocoon. Some larvae spin a criss-cross network of silken strands across the tunnel walls as they retreat. Once inside the cocoon the larva closes the cocoon opening and enters the pre-pupa stage; this usually takes place in October. Several weeks later the last larval skin is shed and a soft, white pupa appears, the cuticle of which hardens over several days.

Pupa

(Fig. 1.)

The thoracic segments are hard and shiny black, the rest of the pupa being a dark brown colour. Most abdominal segments of the pupa are equipped with a ring of blunt spines to assist the pupa in making its way up the bore at emergence. A large female pupa may be 90 mm long and 20 mm in diameter. The adult is usually ready to emerge by mid December.

Various times of emergence have been attributed to *X. liturata* by researchers over the years. Littler (1904) states "The perfect insect emerges generally during the night". Dodd (1916) states "There are several forms of *X. liturata*, perhaps they will in time be separated into species; one form emerges as early as 10 or 11 a.m., another as late as 5 or 6 p.m." All my *X. liturata* emerged in the late afternoon and early evening. The majority emerged at around 5-6 p.m. with some as late as 7.40 p.m. Emergence seems to be associated with hot, windless days, and the great majority of moths in a given area emerge on the same evening.

The pupa first forces its way out of the cocoon which is no mean feat as the exit is very narrow and the surrounding silk and wood flakes, very tight indeed. Dodd (1916) states that this structure is "so thick and tough that the pupa must possess great strength to force its way through". It is even difficult to push a little finger through the cocoons' opening after the emergence of the pupa. Once free of the cocoon the pupa then makes its way along the bore with the aid of the blunt spines (this is probably done in a spiral motion because if a naked pupa is agitated its squirming causes it to rotate) and stops at the thin bark covering the emergence hole, or it may push it out and then protrude for a short distance. Here the pupa stops and the moth inside engages in a pumping action. I have seen pupae keep this up for up to an hour. After this the pupa protrudes further from the emergence hole and stops when the wing cases are visible.

The moth inside now moves up through the pupal sheath and pushes against the line of fracture along the top of the thorax. I have held emerging pupae in my fingers and the force exerted is considerable. Eventually the line of fracture splits, the moth moves up, further widening the split as well as going through similar wing beat movements as when flying which rips the end of the pupal sheath right open. The moth now slowly draws out its antennae and immediately afterwards the fore legs. The moth at this stage is facing the ground so it grasps the tree trunk with its fore legs and twists around, facing vertically up the tree. The rest of the body is drawn out leaving the empty pupal sheath protruding.

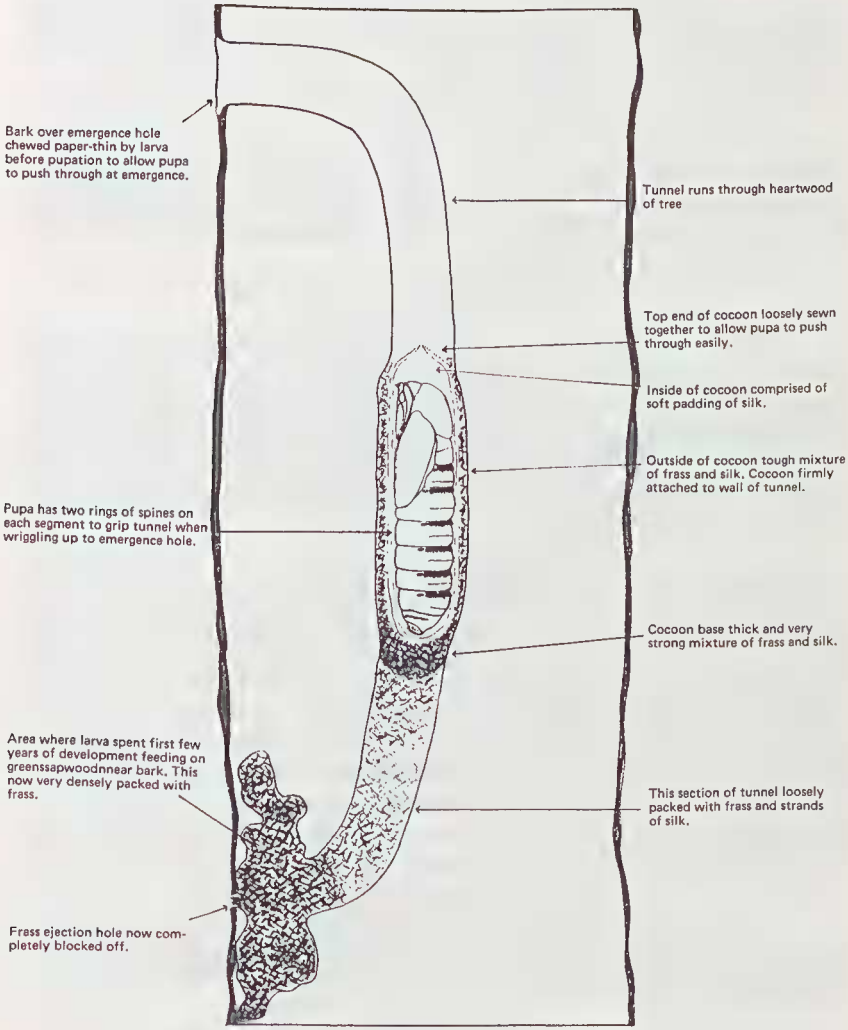

Fig. 1. Pupa, pupal chamber and cocoon of female *Xyleutes liturata*.

Adult

As soon as the moth is free of the pupal sheath it starts to crawl up the tree or around the trunk, at the same time expanding the wings. After several minutes of scrambling about the moth finds a secure perch where it continues to expand its wings which are now raised vertically over the body. When the wings are fully expanded they are lowered into the normal position. The wings take several hours to harden before the moth can fly.

Females appear to attract males with a powerful pheromone. I once placed a newly emerged female on a wattle in our garden and left her there all night. The following morning the moth, to my surprise, was still there and was now accompanied by two males. No moths of either sex had previously been seen in or around the property in twelve years of residence and the only suitable acacia scrub was 2 km away.

Both sexes are strong flyers; gravid females are at first somewhat slow and cumbersome but can nonetheless fly quite well.

Adults vary tremendously in size, more so in females than in males. The smallest female I have collected has a fore wing length of 39 mm and the largest female 75 mm with an abdomen 60 mm long and 24 mm in diameter. The smallest male had a fore wing of 33 mm and the largest 51 mm. The largest female specimen in Australian National Insect Collection, Canberra, has a fore wing length of 92 mm (E. D. Edwards, pers. comm.). Tasmanian specimens occasionally reach this size.

Duration of life cycle

From my observations the life cycle of *X. liturata* varies from 2-4 years, depending on the sex of the larva and the quality of the timber in which it is boring. Male larvae often pupate after two years in the timber but females can take considerably longer. Froggatt (1894) reported claims that the cycle of *X. liturata* occupied "upwards of nine years" but I have not encountered such long periods. After collecting a large number of larvae I have found their growth rate to be slower than I expected. One such larva collected in late September, 1983 was only 15 mm long and 3 mm in diameter. As the adult moths are only active in November and December, at the very youngest this small larva was almost twelve months old.

Acknowledgement

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